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ABSTRACT

Sixth grade students can prepare for the Multnomah County, Oregon, Outdoor School experience by completing the workbook designed to provide fundamental information about soil, water, plant, and animal resources. The workbook begins with an introduction to environmental manners, after which a section is devoted to each resource area. The glossary of terms and words provided for each area is the basis of many of the learning activities which include charts, matching, drawing, labeling, completing study sheets, and games (bingo, crossword puzzles, word searches, word scrambles). The activities specifically address: the water cycle; crayfish; pH; dissolved oxygen; trees; tree measuring; ecosystems; and land use planning. A Teacher's Guide accompanies the workbook. (NB)

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STUDENT PREPARATION WORKBOOK

FOR OUTDOOR SCHOOL ATTENDANCE

Developed By

The Staff And Participating Teachers Of The

Multnomah County Outdoor Education Program. . . . . A Service Of:

220 SE 102nd Avenue
Portland, OR 97216

Multnomah County
Education Service District
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U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

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DECEMBER 1978

THIS NOTEBOOK BELONGS TO: _____

I AM GOING TO: _____ OUTDOOR SCHOOL

FROM: _____ TO: _____

The relationship of Man to the land has undergone many changes. Man has used and converted the natural resources of the land to benefit his life. He has done things that have been bad for the land and bad for himself. Fortunately he has also done other things which have been good for the land and himself.

If man is to survive on earth he must learn to live in harmony with the natural resources because he is totally dependent upon them. Past civilizations flourished when they had plenty of natural resources, but vanished when the supply of resources dwindled.

This study of the affect of the natural resources upon one another and also how Man influences and is influenced by the resources is called "Ecology". This term comes to us from two Greek words that mean "the study of the home".

The first step in learning how to live with our resources is to understand each resource. In this book you will learn about each resource, and when you get to Outdoor School you will see how they all work together.

INTRODUCTION TO ENVIRONMENTAL MANNERS

As you begin your preparation for Outdoor School there are some things you will need to know about studying in the field. By reading the following information carefully you will know what to expect at Outdoor School and what is expected of you.

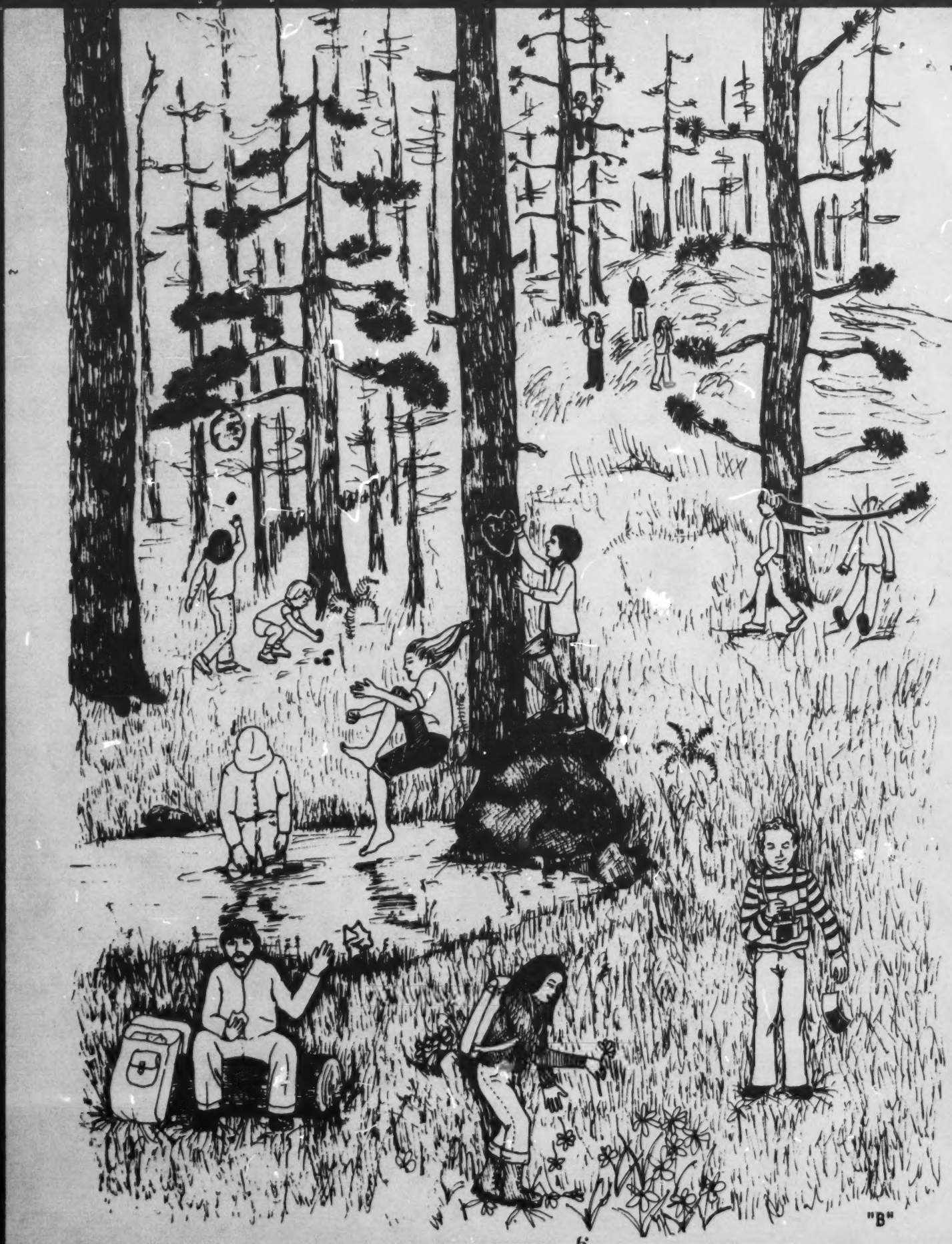
You will need to learn the meaning of some new words so that you will be able to understand what the resource people will be talking about. Each of the studies of plants, animals, soil, and water will have a special language much as each sport has a special language. In addition, during your field study you will also have the opportunity to study the science of ecology. Ecology is the study of how plants and animals live in their environment and how they interact with each other.

During the time that you are in the field, you will most likely be working in small groups of 5 or 6 people, these groups will be scattered over a very large area of land. Because of this you will need to know some do's and don'ts of working in the woods. These simple rules might be called Environmental Manners. They are just good common sense and necessary for your protection and for the protection of others working with you. Just as important is the respect that we have for the land and the plant and animal life there.

Many students have preceeded you at each Outdoor School site, we hope that many will follow. We all have a responsibility to leave the Outdoor School site just as beautiful as we found it.

Look closely at the following pictures. Circle anything that should not be done in the out-of-doors and be prepared to explain your choices.

"A"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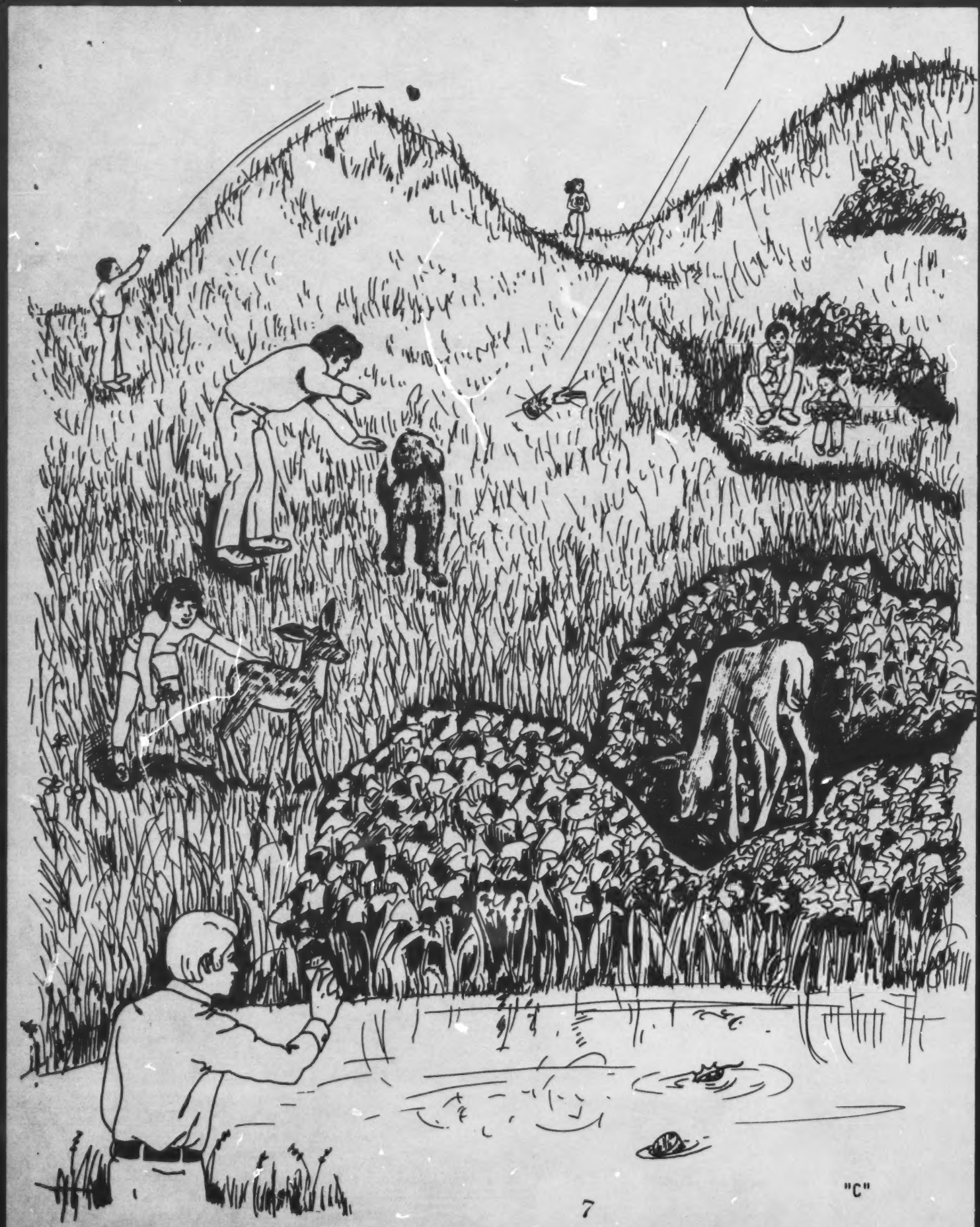


"C"

8

9 "D"

A GLOSSARY OF WATER WORDS

AMPHIBIAN: Means "living in two places". These animals hatch from eggs which have been deposited in ponds or streams. They live in the water like fish when they are young. Gradually they grow lungs and legs, breathe air and live on land.

ANADROMOUS FISH: Those fish which spend the greater part of their lives in salt water, but migrate into fresh-water streams for reproduction.

AQUATIC: Living or growing in water.

AQUATIC ROOTS: Roots that are in the water. They are generally small and lack root hairs.

ARTESIAN WELL: A deep well in which water rises by subsurface (under the ground) pressure.

CAPILLARY WATER: Water held in the fine spaces around soil particles. This water can be used by plants.

CONDENSATION: The process by which water vapor changes to liquid water, usually minute water droplets forming clouds.

CUBIC FEET PER SECOND: A measurement we use to find out how much water is flowing past a certain point every second. A water flow of one cubic foot per second would be about 449 gallons every minute.

CUBIC FOOT OF WATER: The water in a container that is one foot wide, one foot deep and one foot long. One cubic foot of water is about 7½ gallons and weighs 62.4 pounds.

DISSOLVED OXYGEN: The useable oxygen dissolved in the water. It is measured in "parts per million" and is essential to aquatic life. (P.P.M.)

EROSION: The washing away or wearing away of the land surface. Flowing water often makes gullies in the soil.

EVAPORATION: The changing of water into vapor; from a liquid to a gas. Action of the sun warming land and water surfaces.

GRAVITATIONAL WATER: Water that moves downward into the zone of ground water. Water stored in underground streams, caverns and the air spaces in the soil.

GROUND WATER: Water that collects in the ground, concentrating at and below the water table.

HARD WATER: Water containing mineral salts which combine with soap and prevent suds from forming.

A GLOSSARY OF WATER WORDS (Continued)

HYDROSCOPIC WATER: Water which forms a thin film around soil particles. This water cannot be used by plants.

pH: A measure of the concentration of hydrogen ions. More simply, it tells us whether the water is acid or alkaline.

POLLUTION: Caused by dumping wastes into our water. These wastes may cause water to be unuseable.

PRECIPITATION: Moisture falling from clouds or separating from the air such as rain, snow, sleet, hail, frost, fog or dew.

RESERVOIR: A place where water is collected and stored for use, usually related to a man-made structure such as a pond or lake behind a dam.

RIFFLE: A shallow area in a stream bottom that causes the water flowing over it to become broken and uneven in flow.

RUNOFF: Excess water which the ground cannot absorb and which runs off the surface of the ground to enter the drainage system, streams and rivers.

SEDIMENT: Any material carried in suspension in water which will settle out as the speed of the water flow lessens.

SOFTWATER: Water relatively free from minerals.

SPRING: Formed by ground water coming to the surface on top of an impervious layer.

SURFACE WATER: Runoff and also where the water table emerges at the surface of the ground in lakes and streams.

SWAMP: An area of low ground, saturated with water over a long period.

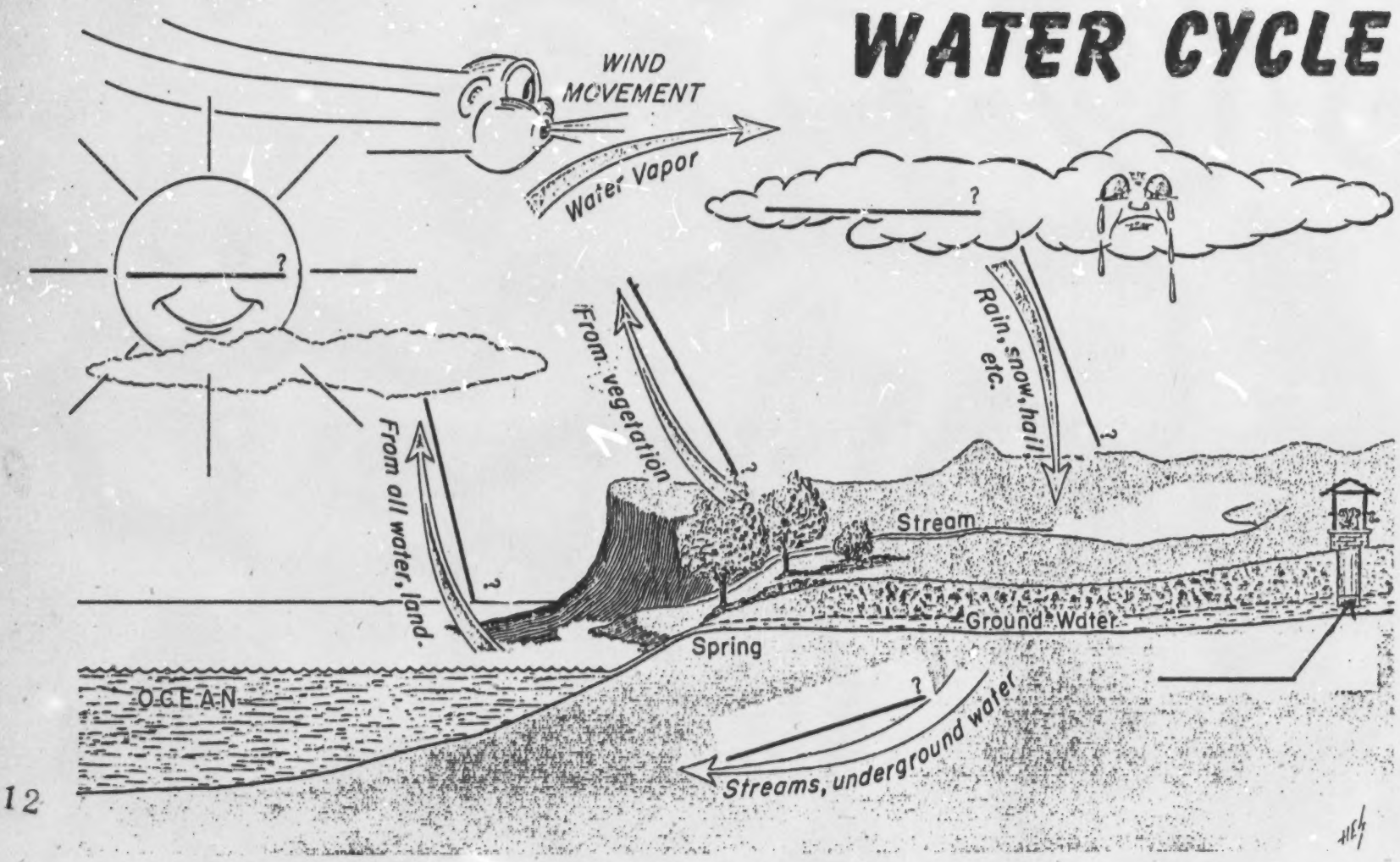
TOXIC: Poisonous. In water it is usually associated with a waste which kills fish and other aquatic life.

TRANSPIRATION: The process by which plants release water into the air from their leaves and other surfaces. This loss is by evaporation.

WASTES: Sewage, water from industrial processes, return irrigation water, or any other water which has been used by man and changed in the process.

WATERSHED: Any area of land which drains into a particular stream or other body of water. A drainage basin.

WATERTABLE: The height at which free water occurs in the soil profile, and as surface water in streams and lakes.



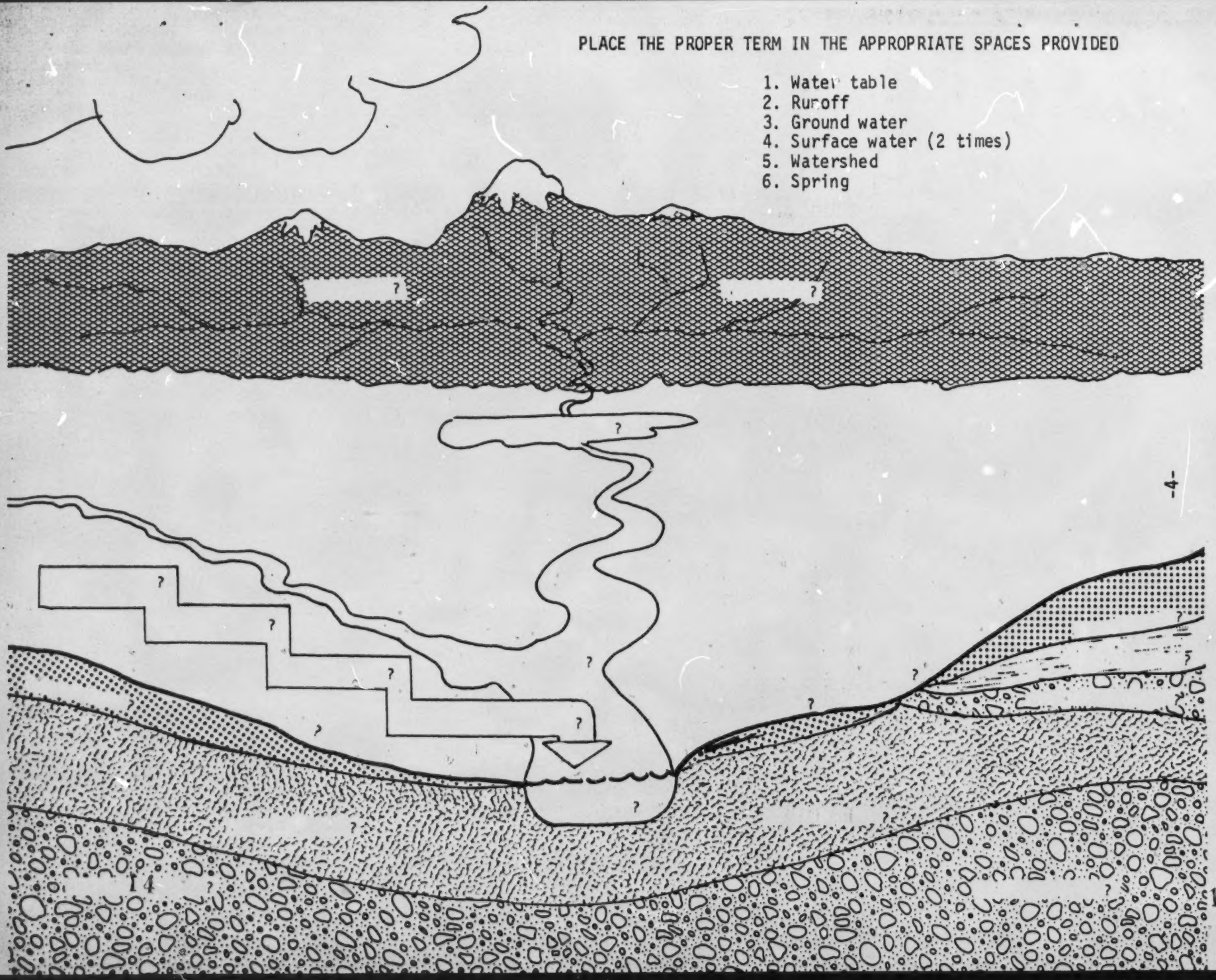
WATER COMES AND GOES FROM EARTH TO SKY IN AN ENDLESS CYCLE

PLACE THE PROPER TERMS IN THE APPROPRIATE SPACES PROVIDED

1. Transpiration 2. Runoff 3. Man-made-well 4. Evaporation 5. Condensation 6. Precipitation 7. Sun

PLACE THE PROPER TERM IN THE APPROPRIATE SPACES PROVIDED

1. Water table
2. Runoff
3. Ground water
4. Surface water (2 times)
5. Watershed
6. Spring



WATER WIZARDRY

WATER AND YOU

A. List 5 ways in which you use water at home

1. _____
2. _____
3. _____
4. _____
5. _____

B. List 5 recreational activities that occur near or in water

1. _____
2. _____
3. _____
4. _____
5. _____

C. Name one way in which industry uses water

D. What use of water is the Pacific Northwest especially dependent upon?

E. How many gallons of water do you think the average U. S. citizen uses per day? _____ gallons per day.

WATERSHED

A. What is a watershed and how does it work?

B. Find the Bull Run River on a map. Who uses the water stored in the reservoirs?

WATER WIZARDRY (Continued)

C. How many reservoirs are there? _____

D. Make a guess as to how many times per month water quality tests are made on the reservoirs _____ times per month.

TYPES OF PRECIPITATION:

A. What is Oregon's most common form of precipitation? _____

B. What is it called when raindrops freeze before hitting the ground? _____

C. What is it called when water vapor freezes before it turns into droplets? _____

D. What is it called when water vapor turns into droplets before it rises into the air from off the ground? _____

E. What is it called when water vapor freezes at the ground level? _____

F. What is it called when a cloud forms close to the ground? _____

G. During a thunderstorm, snowflakes or raindrops are carried up into freezing clouds by strong winds. Up in the cloud they freeze, fall, are carried back up by the wind, freeze, fall, etc. In the process, they become larger and larger until they are too heavy for the wind to carry. They finally fall to the earth.

What form of precipitation is this? (Hint: They can get as big as softballs) _____.

WATER STORAGE:

A. Sometimes we have too much water on the ground and it is called a _____

B. Sometimes we have too little water over a long period of time and it is called a _____

_____

C. How does man try to control water storage to prevent the above?

1. _____
2. _____
3. _____
4. _____

D. How does nature store water?

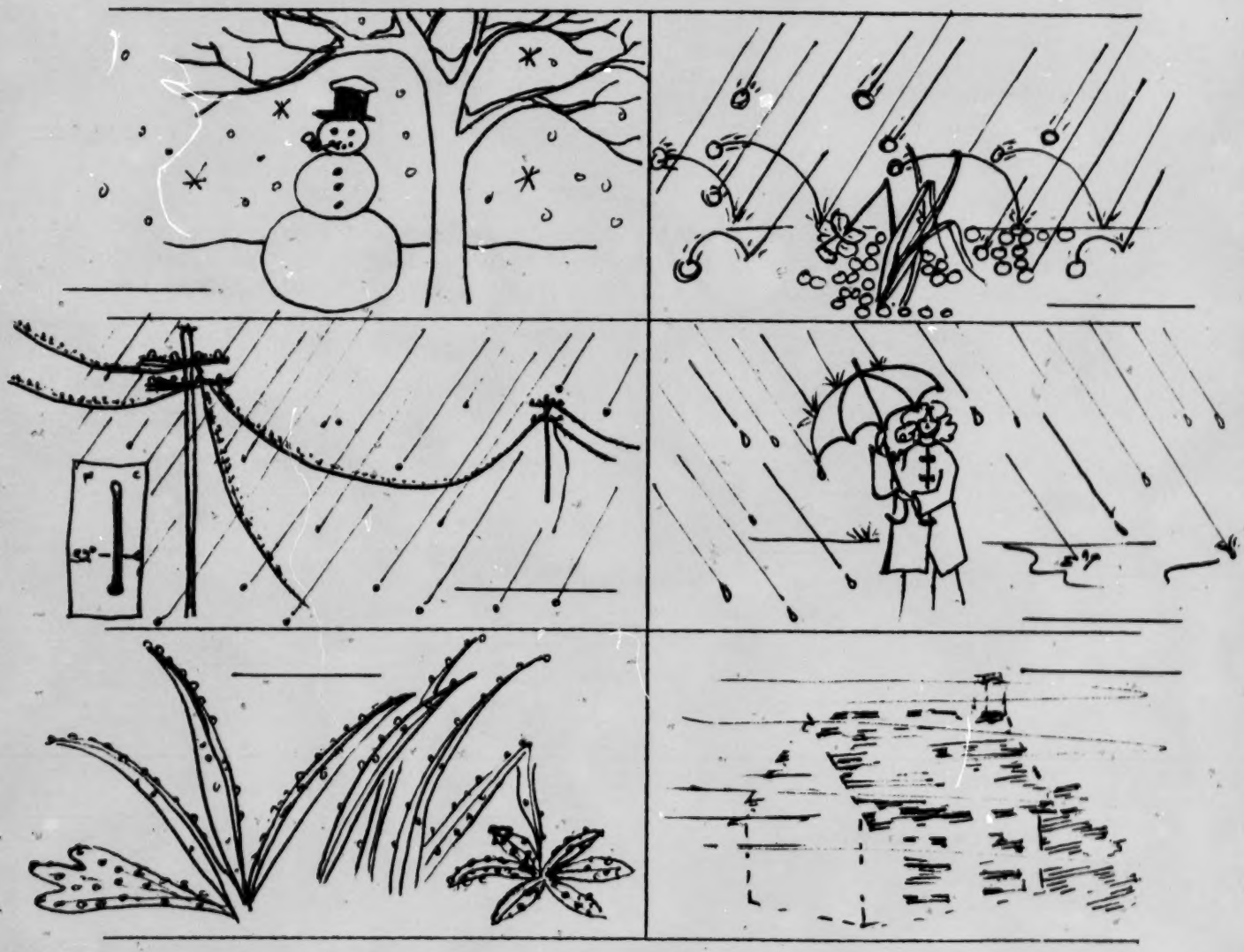
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

MIX AND MATCH

Label each form of precipitation

Here are the possibilities:

Dew	Fog
Snow	Hail
Rain	Sleet



MATH PRACTICE PROBLEMS

While you are at Outdoor School studying water, you will be doing some math problems while studying the stream. These problems will give you some practice.

1. We measured the depth of a stream in three places. We need to know the average depth. Find the average depth by using the measurements below:

   First Measure _____ 5 feet 7 inches

   Second Measurement _____ 6 feet 1 inch

   Third Measurement _____ 3 feet 4 inches

   AVERAGE DEPTH = _____

2. We have a distance measured off of 10 feet. We dropped a leaf or a twig into the water and timed it with a stopwatch to see how long it took to float 10 feet. The stopwatch recorded 2 seconds to time. Now find out how many feet the leaf floated each second.

   THE LEAF FLOATED _____ FEET PER SECOND

3. We found out that there were 270 gallons of water flowing each minute in our stream. What we want to know now, is how many gallons of water flow in our stream each day. How would you figure this out?

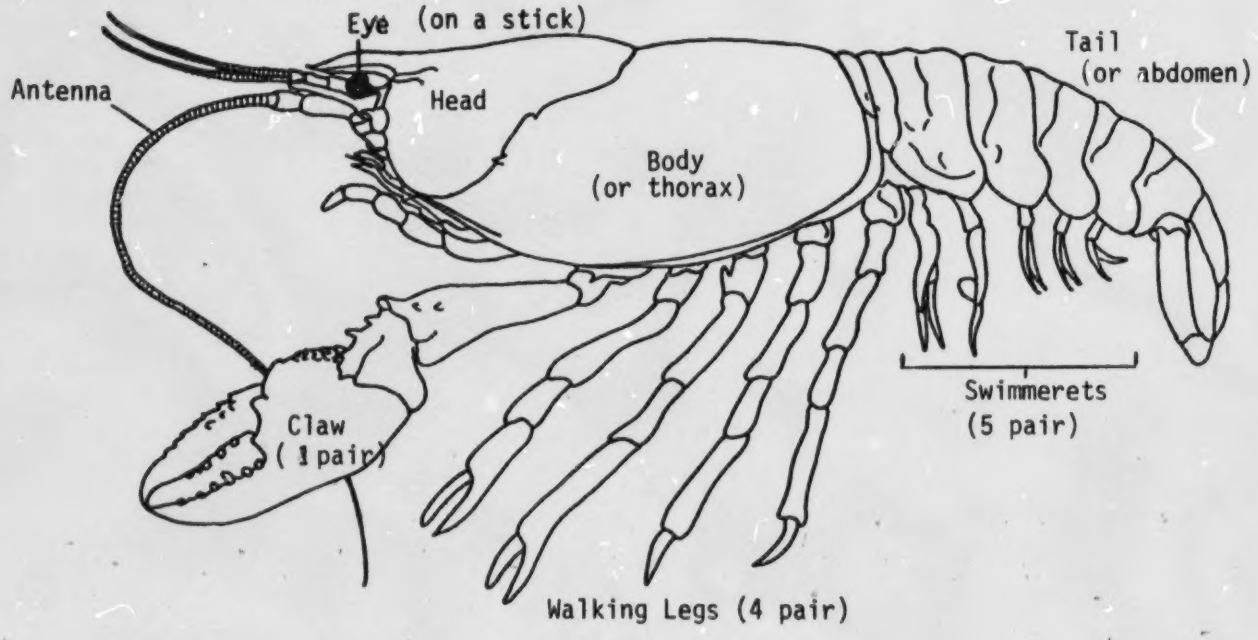
   MY ANSWER IS _____ GALLONS OF WATER PER DAY

4. Now we need to know how many people our stream can support in 24 hours or one day. You have (from #3) the amount of gallons per day. Each person uses about 75 gallons of water per day. Figure out how many people our stream can support.

   TOTAL NUMBER OF PEOPLE = _____

THE CRAYFISH

The stream you will be observing on water study may be the habitat for the crayfish pictured below. By studying the animal's parts and answering the questions you may find out where to look for the crayfish, what it eats and the niche it fills in its habitat.



What purpose do you think the antenna have, especially at night and in muddy water?

_____

What animals might eat crayfish? _____

How would the crayfish use its big claws? _____

What purpose do the small claws on the walking legs serve in a fast-flowing stream?

_____

In which direction would the crayfish move if alarmed? Indicate on your drawing:

During molt Mr. Crayfish is open to predation. What do you think he does during this time? _____ Where _____

Why is the crayfish more active at night? _____

How might a crayfish lose a leg? _____

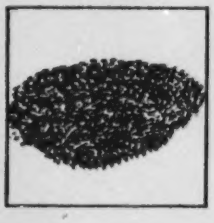
His salt water cousin is called a? _____

WATER IS A HABITAT FOR WATER-LOVING PLANTS AND ANIMALS

PLANTS

Cattail Along the edges of ponds with its roots in water-saturated soil

Skunk Cabbage In swampy areas with its feet in the water



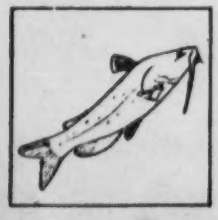
Duckweed Tiny plants that float on pond water with small roots hanging down

Water Lily In ponds with roots fastened to the bottom and leaves and flowers on the surface

Coontail In ponds growing on the bottom and remaining entirely submerged

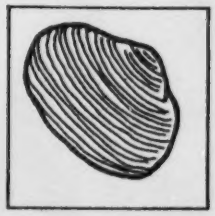
ANIMALS

Crayfish Lives in water, gets oxygen from water through gills—has skeleton outside (exoskeleton)—eats plant and animal material—hides during days—limited mobility by crawling—quick escape mobility by flipping tail (backwards)



Fish Lives in water—gets oxygen from water through gills—eats animal material—highly mobile—swims to escape enemies

Snail Lives in water—gets oxygen from surface (some) or through gills (some)—eats plant material—low mobility on bottom and on plants (snail's pace)—hides in hard spiral shell



Clam Lives on or in the bottom of stream or pond—breathes and eats through a siphon by pumping water in one and pumping wastes out another—stationary—closes shell for protection

Water Strider Lives on the water surface (surface tension) and kicks swiftly along surface to escape enemies—catches other insects for food (predator)

Water Boatman Lives and feeds in the water but comes to surface for oxygen—eats algae or animal material sucked from the ooze on the bottom—fast swimmer to escape enemies

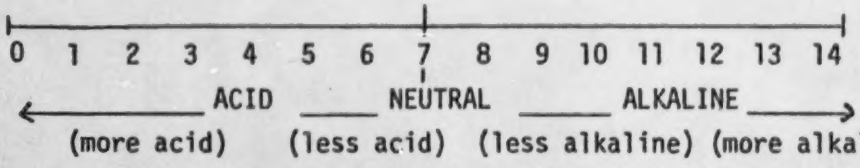
Frog Lives on land and water (amphibian)—eggs laid in water—tadpoles swim in water and breathe through gills—adults emerge to land and breathe through lungs

Dragonfly Adults fly but deposit eggs in water where nymphs hatch and breathe through gills but emerge onto plants to hunt prey (predator)

DESCRIPTION OF pH

pH is a scale of measure to indicate how acid (sour) or how alkaline (sweet) a plant or animal environment is. Aquatic biologists and soil scientists have developed test kits to give them this information. You will use such test kits at the Outdoor School to study plant and animal environment.

pH is measured in a scale of from 0 (very acid) to 14 (very alkaline) with the midway point (7) being neutral, or neither acid or alkaline (sour or sweet).



To find pH, you will test a small sample of water or soil. When you finish the test, you will have arrived at a number. If the number is between 0 and 7, the water or soil is acid; if it is between 7 and 14, it is alkaline; if it is 7 it is neutral. It is more acid or more alkaline the further the number appears from "neutral" (7) on the scale. You can test the pH of other things besides water and soil. On the pH scale below, you can see the pH reading of some common things that you might find in your home.

MORE ALKALI

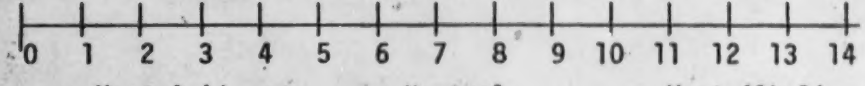
14. ---------- PURE ALKALI (base)
13.
12. ---------- BAKING SODA
11.
10.
9. ---------- SOAP
8.

Neutral 7. ---------- PURE WATER, BLOOD

6.
5. ---------- SOUR MILK
4. ---------- ORANGE JUICE
3. ---------- LEMON JUICE, VINEGAR
2.
1. ---------- PURE ACID

MORE ACID

pH RANGES THAT SUPPORT AQUATIC (water) ANIMAL AND PLANT LIFE



6.5 ↔ 7.5 (Largest variety of animals, trout, mayfly, stonefly, caddis fly

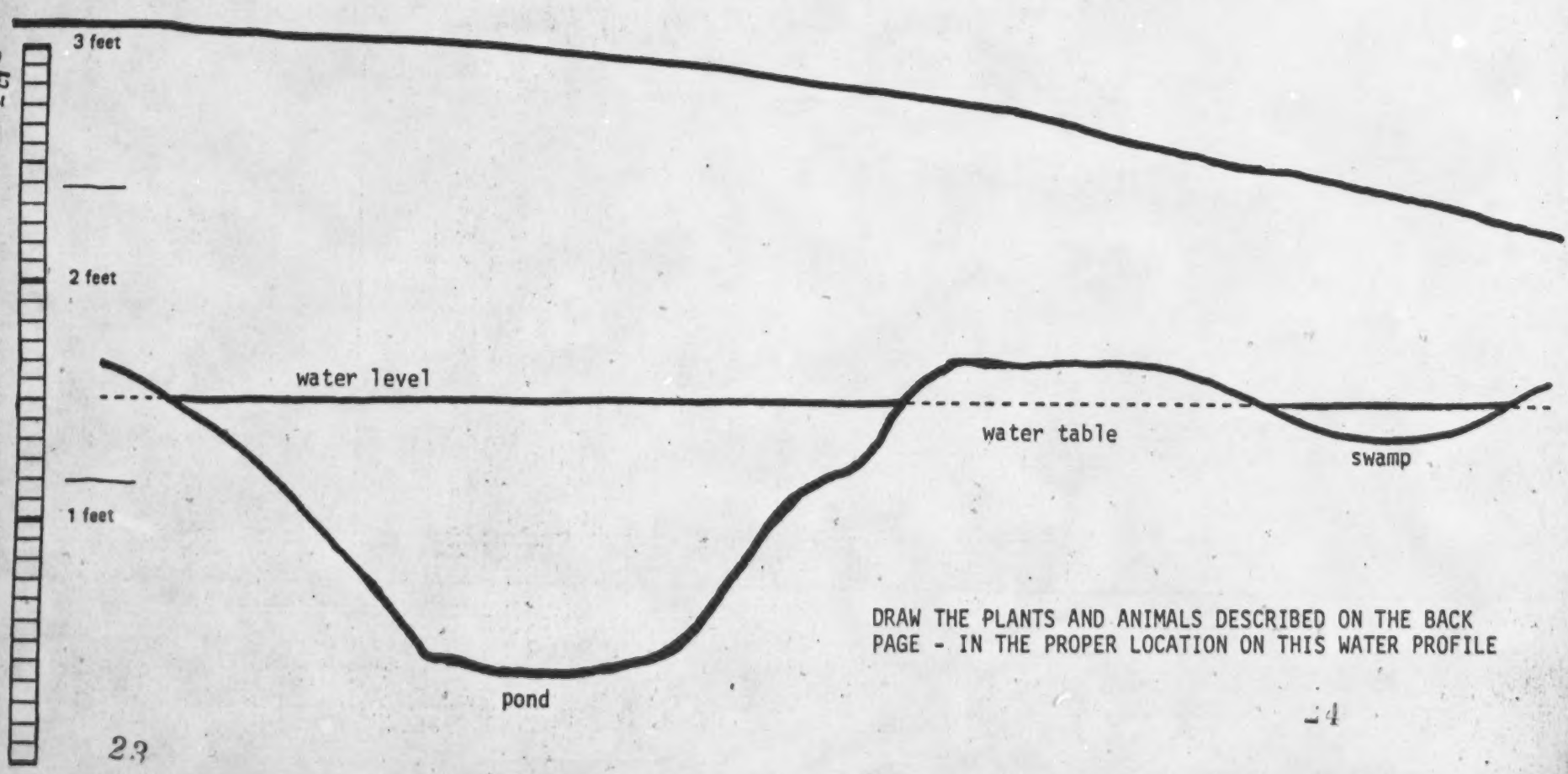
7.0 ↔ 9.0 (Snails, clams)

6.5 ↔ 8.5 (Bass, Crappie)

6.0 ↔ 9.0 (Carp, Suckers, Catfish, some insects)

6.5 ↔ 12.0 (Plants (algae, rooted, etc.)

1.0 ↔ 13.0 (Bacteria)



DRAW THE PLANTS AND ANIMALS DESCRIBED ON THE BACK PAGE - IN THE PROPER LOCATION ON THIS WATER PROFILE

DISSOLVED OXYGEN QUESTIONS

A. What is dissolved oxygen? _____

_____

B. How is it measured? _____

_____

C. Plants or animals cannot live in water with less than _____ PPM of DO to live.

D. Salmon, Trout and Crayfish need at least _____ PPM of DO to live.

E. Under normal conditions DO saturation is reached at _____ PPM.

F. What kind of things tend to reduce the amount of DO water?

1. _____
2. _____
3. _____
4. _____
5. _____

G. What kinds of things tend to increase dissolved oxygen in water?

1. _____
2. _____
3. _____
4. _____

WATER WORDS PUZZLE

DIRECTIONS: Words may go up, down or diagonally. Circle the word when you find it.

P C M A I E V A P O R A T I O N U T W G R E T
C R A W D A D C D E O I R L M R S M A F C I Q
W A E A H B G I C N L L A X D C P E T I H K E
G Z B C O L S D W W I L N A O A J R X N T J G
L N E R I D I E Y G N E S L K O D K E N D Y R
O W H O U P Q A K E L G P R H C W E F U N C S
W I L O B H I I F R M L I B X L S R A O P O O
H A I A S T L T L W O D R U N O F F H S T N E
G E L Q U E G Z A R F K A L V U W P B U F D R
T L N T T S E J Z T C K T L G D I C I Q R E B
S I O F H T V R T G I P I R S S N V K N T N S
T M E A N H E O O V I O O U B S Z G E A D S M
R D I S E U O R U S L E N N J W I I W M H A Y
S T R E A M F L O W I F K I N C O N G N P T O
A T M O A E O O A P T O X U Q A E C R U N I M
L Y O V T R G H Q S I K N O A E N K O W I O I
A Q H L W A T E R W H E E L R R C I D L S N T
M H A O I L D E U I E F A G K A K L J S G H D
A E V A N T K M S L M T A R O G I I R H R U I
N S W R D E W G T I W E S I L A O N O N O P S
D U R A M A Y O I U A E N R N R I Y T A U C S
E O E T O M A S O M N N O S U P T S D C N A O
R I D V V I C K L S E T W A T E R S H E D E L
K M U C E H E N F L O L I E U N T P A W W S V
V P O R M C H F A E S I Q R L U E R I S A V E
A L X F E R U E I E L V A W V L A I L L T B D
J C L O N P D S P T B U L I C H C N E W E O O
B O K J T T M L G E E T N Y M P H G R U R W X
W P O R A G H O C U B I C F O O T B O X T B Y
E K E F A T M X C O L R X L Z D E Y Y V E D G
M L G A A O Y S H R E F A C A R T G A P H X E
N I L P T E S Y U T L C R A P I R C Y Z W L N
B S A L S H I O A L K A L I N E E W T V R A D
M A N M A D E W E L L C G Y T U P L E P R E W

(A) Acid, Alkaline, Artesian Well
(B) Bull Run
(C) Clouds, Condensation, Crawdad, Cubic Foot Box
(D) Dew, Dissolved-Oxygen
(E) Erosion, Evaporation
(F) Fog, Frog
(G) Green Water, Ground Water
(H) Hail
(M) Man Made Well
(N) Nymph
(P) pH Test, Precipitation
(R) Rain, Runoff
(S) Salamander, Siphon, Sleet, Snail, Snow, Spring, Streamflow
(T) Transpiration
(W) Water Cycle, Watershed, Wet, Waterwheel, Wind Movement

WATER STUDY

(MIX AND MATCH)

PLACE THE PROPER RESPONSE IN A SQUARE TO THE RIGHT OF THE PROPER TERM AS TEACHER READS THEM.

SALMON						
DISSOLVED OXYGEN						
CRAYFISH						
SWAMP						
pH						
CADDISFLY						
BASS						
FROG						
WATERSHED						

GLOSSARY OF SOIL WORDS

PRESERVATION:	Not using our natural resources, but leaving them as they are.
CONSERVATION:	Wise use of our natural resources so that we save some for future use.
ECOLOGY:	The study of how plants and animals live and work together in their surroundings.
ORGANIC:	Anything that is living (alive), or has been living (alive).
INORGANIC:	Anything that has never been living.
DECOMPOSE:	To rot, or to decay.
SOIL:	A mixture of decayed organic material and decomposed rock.
DUFF:	Top layer of soil, the rotting vegetable material that helps to make new soil.
TOPSOIL:	Second layer of soil. Best for plant growth.
SUBSOIL:	Third layer of soil -- gives moisture and minerals to plants.
PARENT MATERIAL:	Bottom layer of soil -- the partly decomposed rocks or sand that help to make new soil.
BEDROCK:	The solid rock -- under the four layers of soil.
SOIL PROFILE:	A side view of the layers of soil.
SAND:	Soil that feels gritty, and does not hold together.
SILT:	Smooth soil, settles to the bottom of water.
CLAY:	Soil that is smooth and sticky.
pH:	A test that tells what plants you can grow by showing how acid (sour) or alkaline (sweet) the soil is. The soil that tastes sour to plants - measures between 1 and 7 on pH scale and is on the acid side.
ALKALINE:	Soil that tastes sweet to plants -- measures between 7 and 14 on pH scale.
WEATHERING:	The breaking down of rocks and minerals.
EROSION:	The wearing away of soil by water or wind.

GLOSSARY OF SOIL WORDS (Continued)

SHEET EROSION:	Washes away the layers of soil.
RILL EROSION:	Washes away the soil by water running downhill and making many little streams.
GULLY EROSION:	Washes away the soil by water running downhill and making deep, wide ditches.
BANK EROSION:	Erosion is caused by streams washing away the soil from stream banks.
SPLASH EROSION:	Is caused by raindrops hitting bare soil.
GROUND COVER:	Grasses, plants, shrubs or trees preventing the soil from being worn away by wind or water.
STRIP CROPPING:	Planting rows of different crops to hold the soil together against erosion.
CONTOUR PLOWING:	Plowing across a hill, instead of straight up and down it, to prevent erosion.
TERRACING:	Plowing across a hill and making stairs out of the soil to prevent erosion.

WORD FIND

A B G N I W O L P R V O T N O C I D
C W E F G H I J K E R O S I O N I L
N E C O L O G Y T E R R A C I N G G
O A P D I N O R G A N I C P Q R R G
K T R N S T R I P C R O P P I N G G
C H E A T U V W X O Y Z R A B C R R
O E S S O I L P R O F I L E D L O O
R R E E F B G G U L L Y H I I J U U
D I R T K A A M E L N O P O Q A N N
E N V R R N N T U S S U S S O L L D
B G A W I K X Y I Z O P H O A K C C
B C T C D Y A L E T O P E F I A O O
G H I J K T T E E M N M M P L L V V
Q R O S D T U E V W X Y D O Z I I E
A B N I C J H S A L P S D U C N R R
E F C O N S E R V A T I O N F E H H
P A R E N T M A T E R I A L G F D D

FIND EACH OF YOUR SOIL VOCABULARY WORDS IN THE WORD FIND ABOVE, WORDS ARE FORWARDS, BACKWARDS, AND DIAGONAL.

GOOD LUCK!!!

THESE WORDS ARE FROM YOUR "GLOSSARY OF SOIL WORDS" LIST

UNSCRAMBLE THESE SOIL WORDS

DUSTY TOPL

DNAS

HEETS

GREHNITAEW

ROODUTO CLOHOS

LSIBUOS

LYULG

GYLCEOLO

REFMAPCI

PIRTS PROPGINC

ERFIDNS

NOSEOIR

FUDF

SEEPOOMED

CEESRORU LATCISSIPE

NCIAB

SLATPN

ALLAINKE

VESTRANNOOIC

OILS

NABK

CAINGOR

ROSENI ROSLENCUO

ACYL

RETAW

OORUNCT GIWNOPL

RACERGINT

INJUOR LUCOSNERO

NILMASA

LOSI LIFEROP

PHASSL

SAVENERRPITO

LIST

GANNCIIOR

LIRL

TISE ROSSERPURI

DACI

LIPSOOT

TENARP LATERIAM

CODKERB

NUDORG EVROC

31

FARM FUN

or

("HOW TO PLANT THE RIGHT CROP IN THE RIGHT pH AND MAKE A BUNCH OF MONEY")

Each plant grows in a different pH. Just as you might like sweet-tasting foods (like ice-cream) better than sour-tasting food (like lemons), plants like different tasting soil. Some plants might grow best in soil that tastes sour to them (which is acid on the pH scale) and others might like soil that tastes sweet to them (which is alkaline on the pH scale). But, most plants grow best in soil that is sort of bland tasting, and which is neutral or 7 on the pH scale, so, pH shows how the soil tastes to plants.

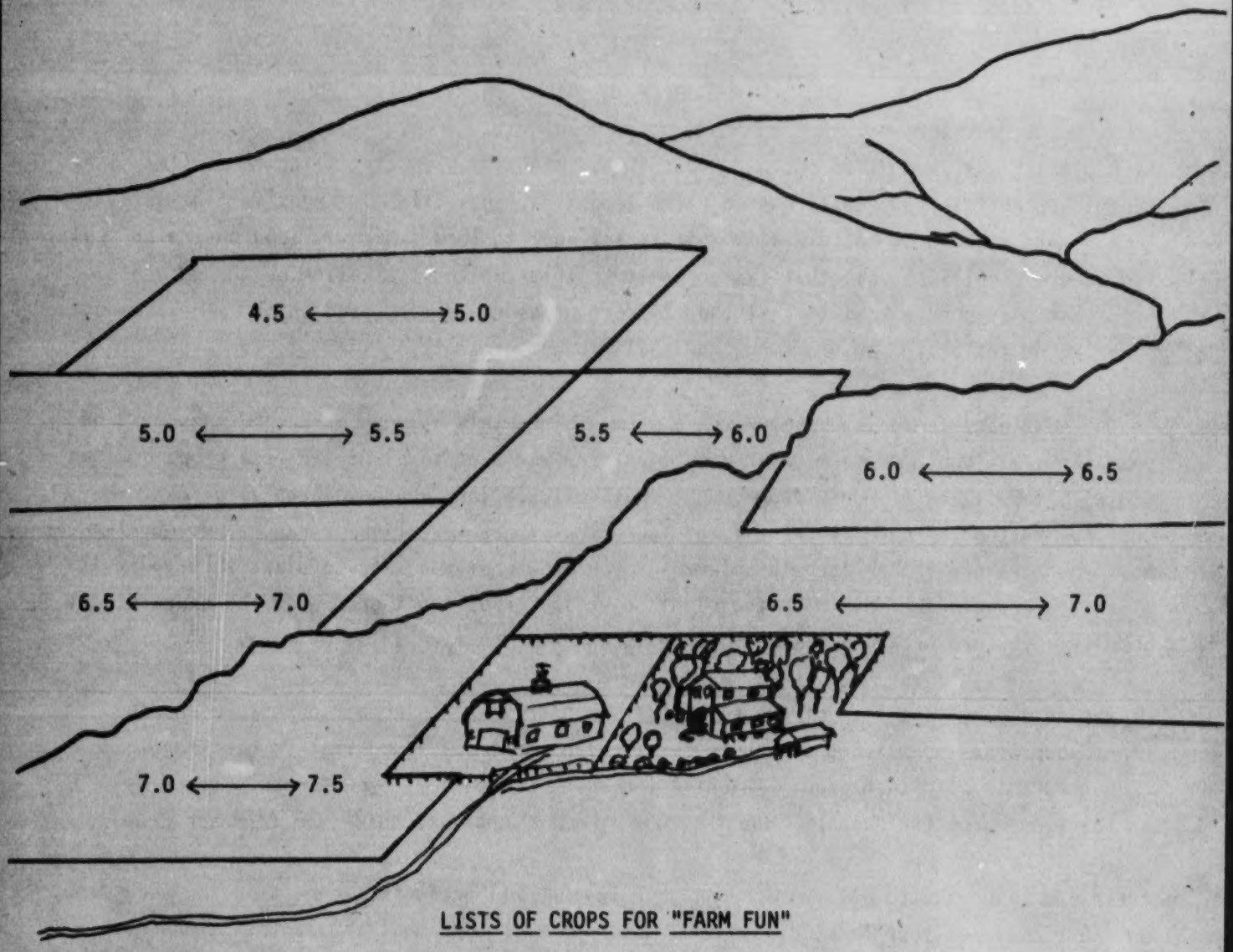
On the next page there is a picture of a farm. Since this is your workbook, this must be your farm. It's a nice farm, with good land, and you want to plant the best crops so that you will make a lot of money from your farm. Well, so far, you have been very smart ---- you have tested the pH of your soil and found that there were five pH ranges on your farm. Now, you have one rather large problem ---- you know what you want to plant, but you must plant the crop in the soil with the right pH or that crop won't grow. If the crop doesn't grow ---- you are broke! If the crop does grow ---- you make a lot of money!

On the next page is a list of crops you want to plant, with a number next to each crop. Plant your crops by writing the number of the crop next to the pH that is <u>best</u> for that crop. Do this with each crop ---- until you have "planted" all your crops. There is <u>at least</u> one crop for each pH. Use the soil pH range chart to guide you for each crop.

After you have planted all your crops, your teacher will read the correct pH for each crop. On the picture of your farm, circle the number of each crop that is planted in the soil with the right pH. Then, count all the numbers you have circled, and this will give you the number of correct answers you have. Each crop that is planted in the right pH is worth $1,000 (because it will grow and you can harvest it). To find out how much money you make, write the number of correct answers you have on the line below, multiply it by 1,000 and you will find out how rich you are.

_____ X 1,000 = $_____

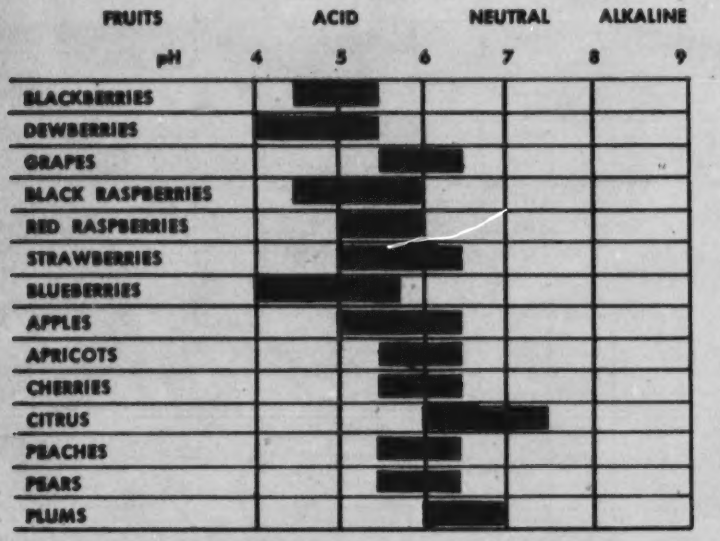
FARM FUN



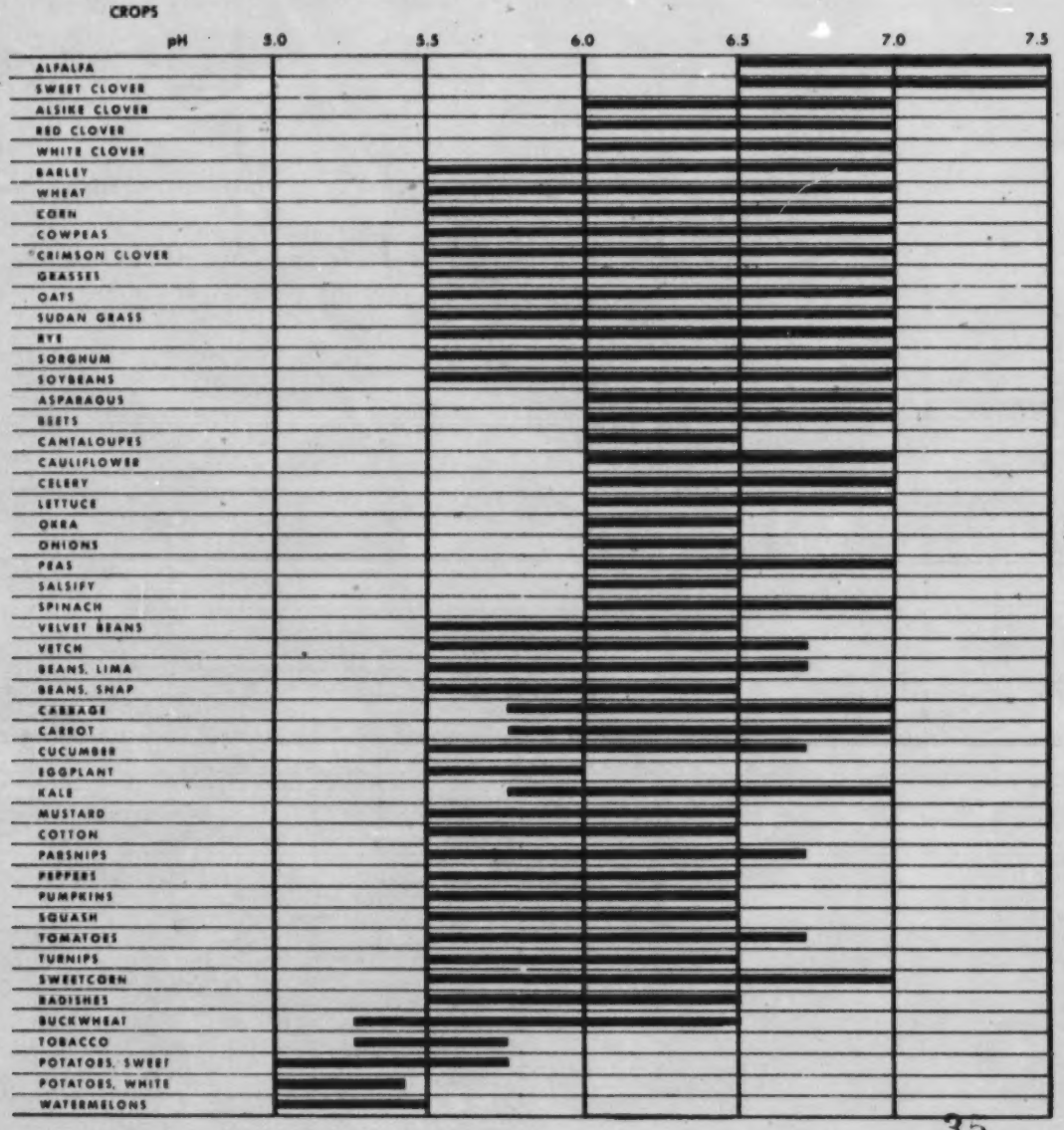
LISTS OF CROPS FOR "FARM FUN"

1. Asparagus
2. Corn
3. Grapes
4. Oats
5. Lemon
6. Pears
7. Apple
8. Beets
9. Lettuce
10. Sweet Potatoe
11. Lime
12. Potato, White
13. Sweet Clover
14. Bluberry
15. Wheat
16. Carrot
17. Beans (snap)
18. Egg Plant
19. Strawberry
20. Tomato
21. Tobacco
22. Barley
23. Blackberry
24. Alfalfa
25. Watermelon

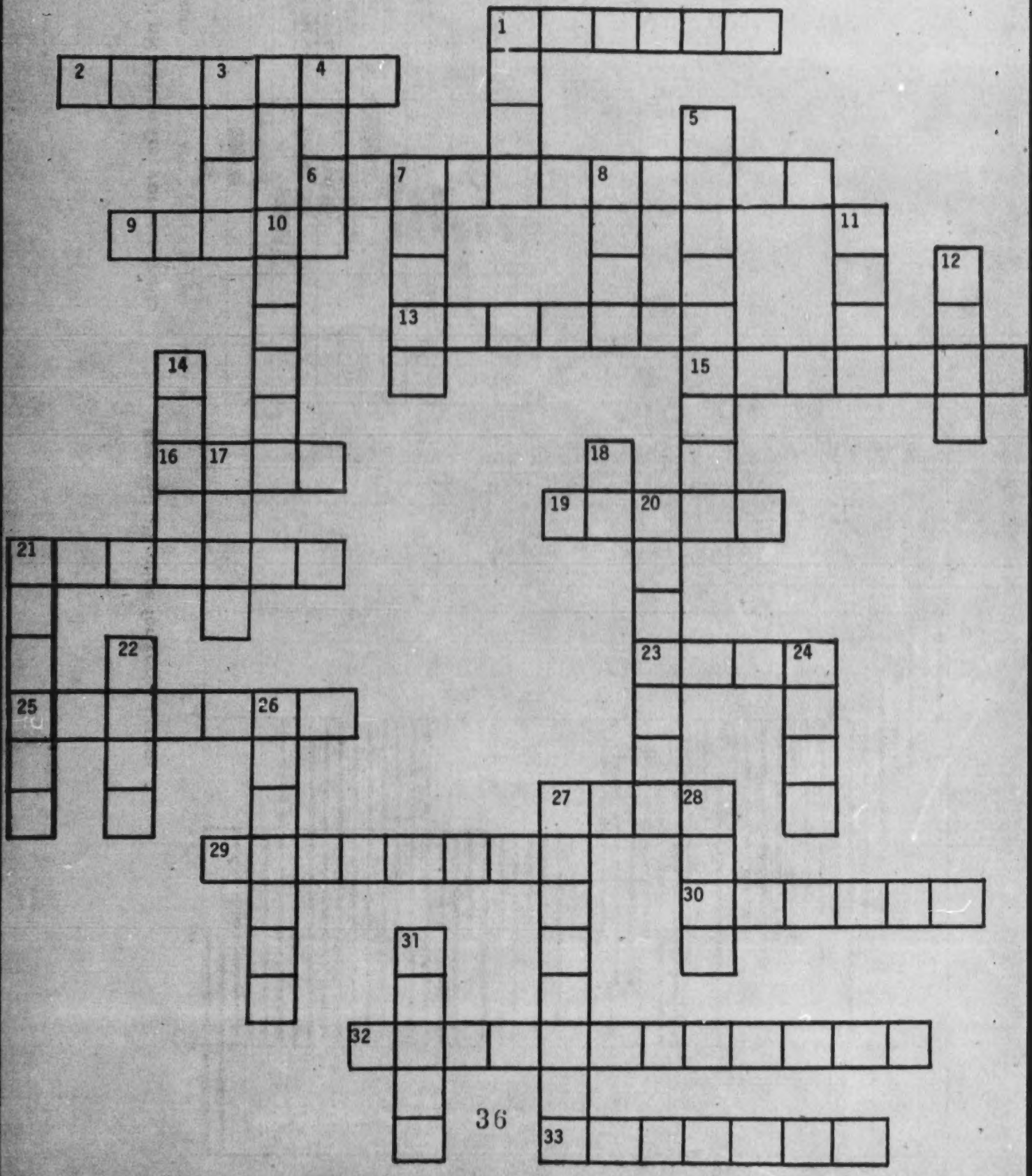
Best soil pH range for various fruits



Best soil pH range for various crops



SOIL CROSSWORD PUZZLE #1



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SOIL CROSSWORD PUZZLE #1

PLEASE USE YOUR SOIL VOCABULARY

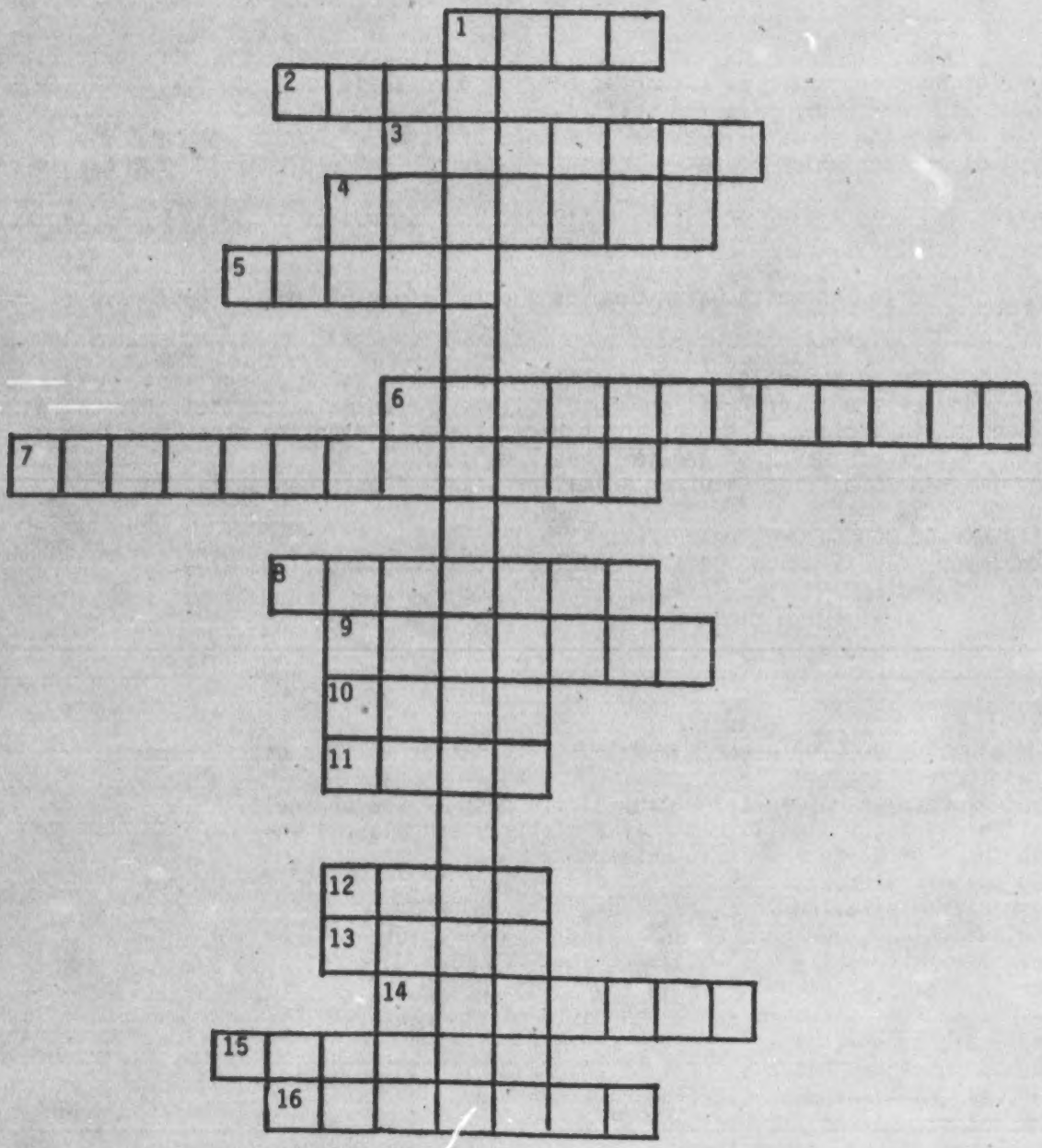
ACROSS

1. Type of erosion caused by raindrops hitting bare soil.
2. The solid rock underlying the soil layers.
6. Type of erosion speeded up by Man's misuse of land.
9. Type of erosion which leaves ditches that may be too deep and wide for machinery to cross.
13. Matter which is living or has been living, and is subject to decay by bacteria.
15. The feel of soil.
16. Type of erosion caused by streams washing soil from stream banks.
19. Type of erosion in which water removes the top layer of soil without easy to see channels.
21. A cross section view of the soil layers.
23. Medium sized soil particles which settle out of the water as sediment.
25. The study of the inter-relationship of plants and animals and their environment.
27. Loose single-grained particles which have little tendency to stick together.
29. When a substance has a pH greater than 7.0, it is _____.
30. Any impression or remains of an animal or plant of past geological ages, preserved in rock.
32. Wise use of our natural resources.
33. The layer of soil which contains nutrients that support plant growth.

DOWN

1. A mixture of decayed organic and inorganic matter which usuatly supports plant growth.
3. Type of erosion which leaves many small, easy-to-see channels.
4. Soil particles so small that they are sticky and plastic when wer.
5. The shape of soil; how it is built.
7. Top soil is a darker _____ than subsoil.
8. Liquid precipitation which can cause erosion.
10. A plant which grows on rock and helps turn rock into soil by secreting an acid from its roots.
11. The part of a plant which is in the soil.
12. Misplaced soil which no longer supports plant growth.
14. Under the topsoil is _____ soil.
17. When a substance has a pH of less than 7.0, it is _____.
18. The measure of acid or alkaline is a substance.
20. The act of wearing away soil by wind or water.
21. The layer of soil consisting of broken up rock and sand which is under the subsoil is called _____ material.
22. Soil composed of an ideal mixture of sand, silt, and clay.
24. Each person consumes 50 _____ of food in his lifetime.
26. The study of the earth's crust.
27. Particles deposited after suspension in water, such as when flowing water stops flowing.
28. The top layer of soil composed of partially decomposed organic matter.
31. A slanting or tilting surface.

SOIL CROSSWORD PUZZLE #2



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SOIL CROSSWORD PUZZLE #2

PLEASE USE YOUR SOIL VOCABULARY

ACROSS ONLY

1. Rock ground into small grains.
2. Very small bits of soil that settle out of the water as sediment.
3. The third layer of soil which gives moisture and minerals to plants.
4. The solid rock which lies under the layers of soil.
5. Type of erosion which makes deep, wide ditches.
6. The wise use of our natural resources.
7. A view of the layers of the soil.
8. The layer of soil which is best for plant growth.
9. The study of the earth's crust.
10. When something has a pH of less than 7.0, it is _____.
11. Type of erosion which leaves many small streams.
12. Top layer of soil made of decaying material.
13. Smooth soil that is sticky when wet.
14. The study of plants and animals in their surroundings.
15. Type of erosion which removes a thin layer of soil.
16. The wearing away of soil by water or wind.

GLOSSARY OF PLANT WORDS

ALGAE:	Most primitive form of plant from which all other groups of plants have probably been derived. They vary in size from very small land forms to giant seaweed as long as 150 feet. This is the green material on the side of a fish bowl.
BERRY:	Any small juicy and stoneless fruit.
BUSH:	Any low shrub with many branches.
FERN:	A plant with feather-like leaves which reproduces by spores.
FLOWER:	The part of a plant which contains the organs of reproduction from which seeds develop.
FUNGUS:	Form of plant life which has no chlorophyll so must obtain its food from other living things.
LICHEN:	A plant which consists of two, an algae and a fungus.
MOSS:	A primitive plant form that reproduces by spores instead of seeds.
TREE:	A plant that usually grows tall and which has a trunk and branches.
ALTERNATE:	Leaf pattern - leaves growing first on one side of the stem and then on one side of the stem and then on the other but not across from one another.
BROAD LEAF:	A plant having flat, broad leaves, instead of needles like on pines, firs, etc.
COMPOUND LEAF:	Leaf consisting of several leaflets attached to a single leaf stem.
CONIFER:	A tree which usually is evergreen and has needle shaped leaves. It is a cone bearing tree.
DECIDUOUS:	A plant whose leaves drop off in the fall of the year.
EVERGREEN:	A plant which stays green all year.
INTOLERANT:	A sun loving plant which does poorly in the shade.
OPPOSITE:	Leaf pattern - leaves growing across from one another on a stem.
PALMATE:	A leaf arrangement in which several leaflets start from a single point and form a shape like a hand with fingers.
PINNATE:	Leaf having leaflets arranged opposite each other on two sides of the stem - like a feather.
SIMPLE LEAF:	A leaf which isn't divided.
TEETH:	Projections on the edges of leaves which look like teeth.
WHORLS:	A circular arrangement of leaves on a stem at one point.
BARK:	Protective covering on the outside of a tree or shrub.
CAMBIUM LAYER:	Layer of growing tissue between the bark and the sapwood.
CHLOROPHYLL:	The green coloring matter of plants necessary for the plant to make it's own food. (Photosynthesis)
CONE:	The seed bearing body of such trees as Douglas Fir, Hemlock, Pines, etc.
LOBED:	Leaf having deep indentations between the major veins.

GROWTH RINGS: The amount of wood a tree grows in one year.

HEARTWOOD: The inner core of a tree trunk made of nonliving cells which is usually darker than sapwood. Gives the tree strength.

LEAF: A green, usually flat part of a plant that grows from the stem or roots and is the place where most photosynthesis takes place.

NEEDLE: A thin, pointed leaf, like that of the Douglas Fir.

PETAL: One of the divisions of a flower which is usually brightly colored.

ROOTS: Part of a plant which usually grows in the ground. It anchors the plant and feeds the plant.

SAP: The liquid inside the trunk of a tree.

SAPWOOD: Soft living part of trunk which contains tubes which carry water and minerals from roots to leaves.

SEED: The reproductive part of a flowering plant which contains the egg cell.

SPORES: One-celled seeds found in plants, like ferns.

STEM: The stalk which supports a leaf, flower or fruit.

TRUNK: The main stem of a tree.

CARBON DIOXIDE: Gas which we breathe out and the plant takes in during photosynthesis (daytime).

OXYGEN: Colorless gas that is given off by plants during photosynthesis (daytime).

PHOTOSYNTHESIS: The process by which plants used water, CO_2 and sunlight to make food.

BOARD FOOT: Unit of measuring lumber - 12" x 12" x 1".

CIRCUMFERENCE: Measurement around a circle.

D.B.H. Diameter of tree at breast height (4½ feet).

DIAMETER: Length of a line from one side of a circle to the other through the center.

COMMUNITY: A group of plants growing in the same area and in the same conditions.

DUFF: Decayed organic matter on top of the soil.

NURSE LOG: Decaying log which provides a seed bed for other plants.

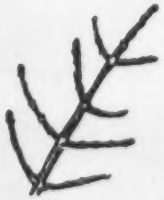
PLANT SUCCESSION: One plant community following another.

MIX AND MATCH

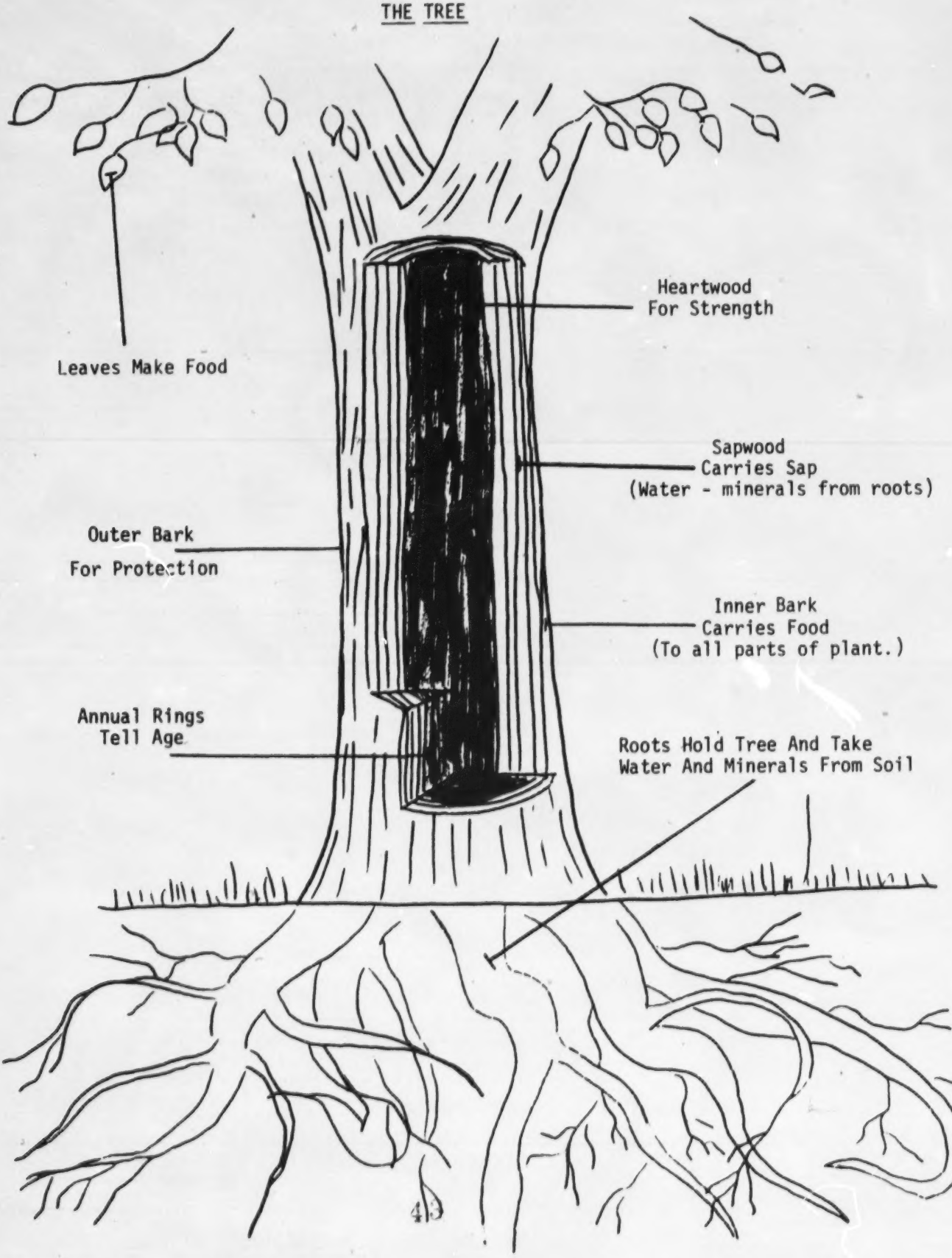
PLANT CHARACTERISTICS

Label each of the items below using the following terms:

1. Palmately compound leaf
2. Whorl branched
3. Alternately branched
4. Pinnately lobed leaf
5. Simple leaf
6. Opposite branching
7. Palmately lobed leaf
8. Needle leafed
9. Pinnately compound leaf



THE TREE


Heartwood
For Strength
Leaves Make Food
Sapwood
Carries Sap
(Water - minerals from roots)
Outer Bark
For Protection
Inner Bark
Carries Food
(To all parts of plant.)
Annual Rings
Tell Age
Roots Hold Tree And Take
Water And Minerals From Soil

THE TREE

HOW TO MEASURE THE HEIGHT

1) Choose a stick the same length as your arm held out in front of you.

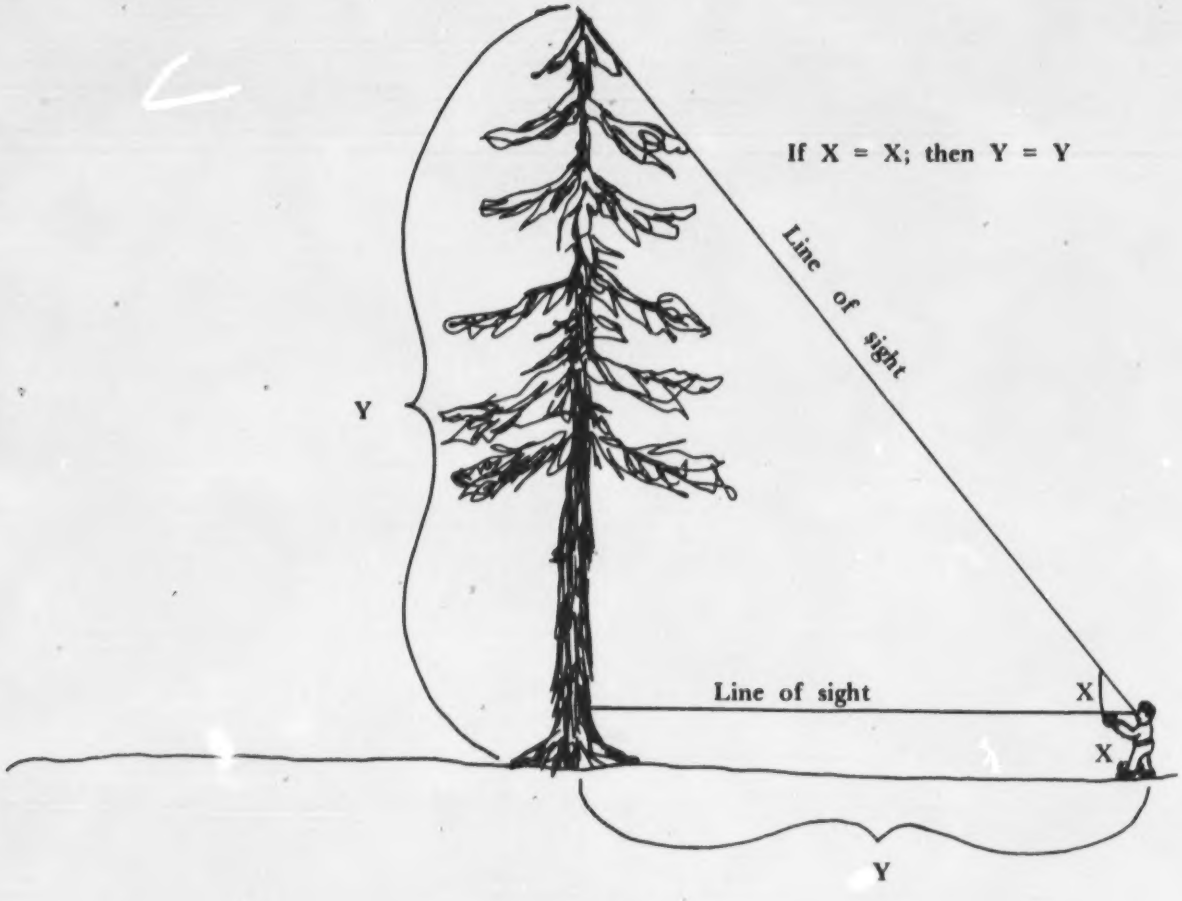
2) Now hold stick upright to form a right angle.

3) Walk backward away from the tree on level ground, sighting across the upper end of the stick you are holding upright and the bottom of the stick above your fist.

4) Continue to walk backward until you can see the top of the tree at the top of the stick and the bottom of the tree at the top of your fist.

5) You are now the same distance from the tree as the height of the tree. Measure the distance from you to the tree and you will have the height.

Number of steps _____ x length of step _____ = height of tree



THESE ARE FROM YOUR "GLOSSARY OF PLANT WORDS" LIST

UNSCRAMBLE THESE PLANT WORDS

TONSSIHPOYHEST

GUSNUF

LOPHOLCYLRH

FUDF

FOGSRULDIA (2)

GEERVERNE

NATATELER

MOELKCH

TOPSOPIE

PUDMONOC

KONC

TOADBOROF (2)

CUDSIUDEO

LEMPA

RONICESUOF

MAREDIET

NECO

SAPNLT

ROUTSOOHCLOOD (2)

WARPAOCMDH (2)

KABR

SROTO

PEERORNGOAG (2)

MIX AND MATCH

FIND THE DEFINITION ON THE RIGHT WHICH MATCHES THE WORD ON THE LEFT AND WRITE THE LETTER IN THE SPACE PROVIDED.

1.	Photosyntheses _____	G.	Dead plant material on top of the ground
2.	Chlorophyll _____	P.	Evergreen with droopy top
3.	Douglas Fir _____	J.	12 x 12 x 1 inches
4.	Alternate _____	C.	Measurement through a circle
5.	Opposite _____	K.	Protects a tree
6.	Conk _____	N.	Holds seed
7.	Deciduous _____	A.	Looses leaves
8.	Coniferous _____	R.	Leaves growing across from each other
9.	Cone _____	H.	State Tree
10.	Roots _____	S.	Plants making food
11.	Bark _____	L.	Green material in plants
12.	Oregon Grape _____	D.	Anchors the tree
13.	Diameter _____	E.	State Flower
14.	Maple _____	D.	Seeds are like helicopters
15.	Board Foot _____	Q.	A leaf with many leaflets
16.	Compound _____	B.	Trees which have cones
17.	Hemlock _____	T.	Hard fungus on side of tree
18.	Evergreen _____	I.	Leaves growing on every other side of a stem
19.	Duff _____	F.	Trees which stay green all year
20.	Fungus _____	M.	A plant which can't make its own food

PLANT WORD FIND

FIND THESE MISSING 46 WORDS THAT ARE WRITTEN VERTICAL, HORIZONTALLY OR DIAGONAL BUT, ALWAYS FORWARD!

CHLOROPHYLL
PHOTOSYNTHESIS
LEAF
TRUNK
ROOTS
BARK
PETAL
STEM
TEETH
COMMUNITY
OREGON GRAPE
BERRY
LEVEL
ALTERNATE
OPPOSITE
WHORLS
SIMPLE
COMPOUND
PINNATELY
PALMATELY
CARBON DIOXIDE
OXYGEN
NEEDLE
CONE
SEED
SAP
NURSE LOG
BOARD FOOT
CIRCUMFERENCE
DIAMETER
GROWTH RINGS
SPORES
WATER
BROAD LEAF
TREE BUSH
ALGAE
CONIFER
EVERGREEN
DICIDUOUS
D.B.H.
HEARTWOOD
SAPWOOD
INTOLERANCE
PLANT SUCCESSION
FLOWER

F C A B U S H S P O R E S B X C A
L I H E A R T W O O D A S Q S O C
O R S T O P S E W H O R L S T N D
W C A B R M C O M P O U N D W I H
E U N D E C I D U O U S L X G F J
R M P B G E V E R G R E E N O E O
A F G H O A L G A E B C A R P R X
P E S T N O P K L R A B F O P S Y
A R I J G H H I T T R S T O O P G
L E M A R S O P R S K T U T S C E
M N P L A N T S U C C E S S I O N
A C L T P R O A N V H E T B T M G
T E E E E F S P K L L T R O E M R
E B P R N L Y W L M O H E A D U O
L R I N O E N A S T R N E R I N W
Y O N A S V T T A B O N O D A I T
X A N T S E H E P C P U V F M T H
Y D A E P L E R W X H R S O E Y R
Z L T S Q M S D O P Y S T O T S I
N E E D L E I J O P L E F T E F N
M A L M N O S T D E L L M N R S G
P F Y C A R B O N D I O X I D E S
I N T O L E R A N C E G B E R R Y

TERMS USED IN ANIMAL STUDY

This list is not intended to be used as a dictionary, but rather as an aid to improving your vocabulary before attending Outdoor School: The terms are not in alphabetical oder, but are in related groups, each group small enough to be easily learned. In the definitions, the words in CAPITAL LETTERS are important things to remember.

VERTEBRATES:	Animals with BACKBONES.
INVERTEBRATES:	Animals WITHOUT BACKBONES. Some have exoskeletons.
EXOSKELETON:	The OUTSIDE SKELETON of animals such as insects and crayfish.

VERTEBRATES

MAMMAL:	Warm-blooded vertebrate, HAIR, FEEDS YOUNG ON MILK.
BIRD:	Warm-blooded vertebrate, FEATHERS, eggs with limey shells.
REPTILE:	Cold-blooded vertebrate, DRY, SCALY SKIN, (snake, lizard, turtle)
AMPHIBIAN:	Cold-blooded vertebrate, SKIN SMOOTH & SLIPPER (frog, salamander)

INVERTEBRATES WITH EXOSKELETONS

INSECT:	THREE PART BODY, SIX LEGS, adults usually have wings.
SPIDER:	TWO PART BODY, EIGHT LEGS, no wings.
CENTIPEDE:	Exoskeleton in many sections, each section having 2 legs (1 pair)
MILLEPEDE:	Exoskeleton in many sections, each section having 4 legs (2 pair)

INVERTEBRATES WITHOUT EXOSKELETONS

SNAIL & SLUG:	NO SKELETON, SLIMY, ONE LONG, FLAT FOOT, with or without shell.
EARTHWORM:	NO SKELETON, SLIMY, long segmented body, no legs.

CARNIVORES:	Animals that eat meat.
HERBIVORES:	Animals that eat plants.
OMNIVORES:	Animals that eat both meat and plants.
PREDATORS:	Animals that kill other animals for food.
SCAVENGERS:	Animals that eat dead and decaying animal and plant life.
PARASITES:	Animals or plants that obtain food from living organisms.

DIURNAL:	Most active during daylight hours.
NOCTURNAL:	Most active at night.

HIBERNATE: To spend the winter in a deep sleep usually because of cold.
ESTIVATE: To spend the summer in a deep sleep usually because of drouth.

AQUATIC: Living or growing in water, applied to either plants or animals.
TERRESTRIAL: Living or growing on land, either plants or animals.

NATIVE: An animal or plant naturally found in this area.
EXOTIC: An animal or plant NOT NATIVE to this area (imported).

ENVIRONMENT: All those factors which make up the surroundings of any living thing.

HABITAT: The environment in which an animal can exist, providing all of the things that the animal must have, WATER, FOOD, & SHELTER.

CARRYING CAPACITY: The greatest number of animals that can live in an area.

LIMITING FACTOR: Whichever of the three essentials, WATER, FOOD, or SHELTER is used up first, thus limiting the carrying capacity.

PROTECTION FROM ENEMIES

Some animals have developed special parts or organs that they can use to protect themselves or their homes from enemies. Can you match the name of the animals with their means of defense?

1.	_____ SKUNK	A.	POISON FANGS
2.	_____ BEES	B.	SHELL COVERING
3.	_____ RATTLESNAKE	C.	ANTLERS
4.	_____ SNAIL	D.	SPINES
5.	_____ COW	E.	BAD-SMELLING FLUID
6.	_____ DEER	F.	STINGERS
7.	_____ PORCUPINE	G.	HORNS
8.	_____ DOG	H.	TEETH
9.	_____ CAT	I.	TALONS
10.	_____ HAWK	J.	SHARP TEETH AND CLAWS

UNSCRAMBLE - ANIMAL WORDS

THESE WORDS ARE FROM YOUR "GLOSSARY OF ANIMAL WORDS" LIST.

DIPRES

LAMAMM

DEETPINCE

GLUS

RADLUIN

BIIPHAANM

RIDB

TISSEPAAR

MORTHWEAR

TIXOCE

TANNMUIR

AESTREBREVT

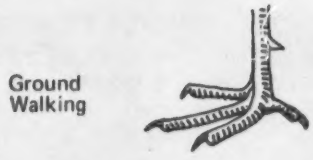
ROOVSINEM

NECTIS

NOXSEOKEETL

ANIMAL ADAPTATION

Flesh eating



Ground Walking

Straining

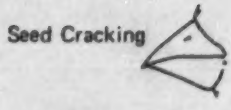
Tree Climbing

Insect Catching

Perching

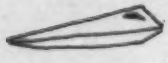
"BIRD MIND—BOGGLER"

Draw the right beak and foot with each bird.



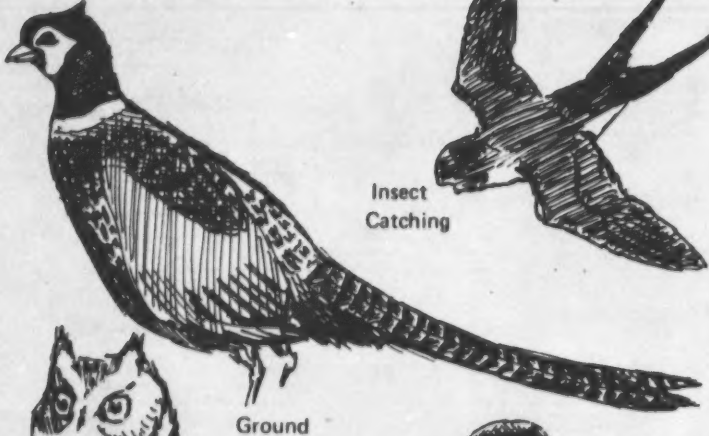
Seed Cracking

Grasping and Killing



Chiseling

Swimming



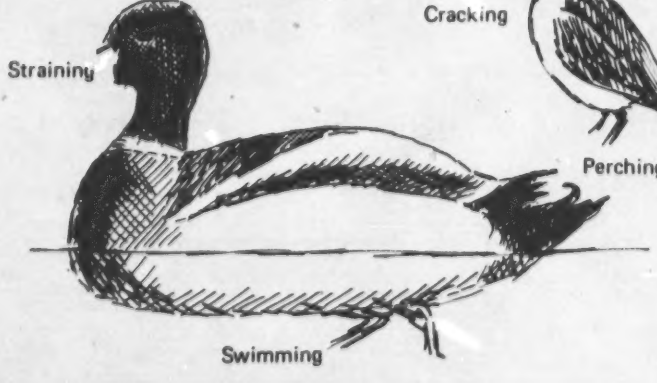
Insect Catching

Chiseling

Tree Climbing

Flesh Eating

Ground Walking



Straining

Seed Cracking

Perching

Grasping & Killing

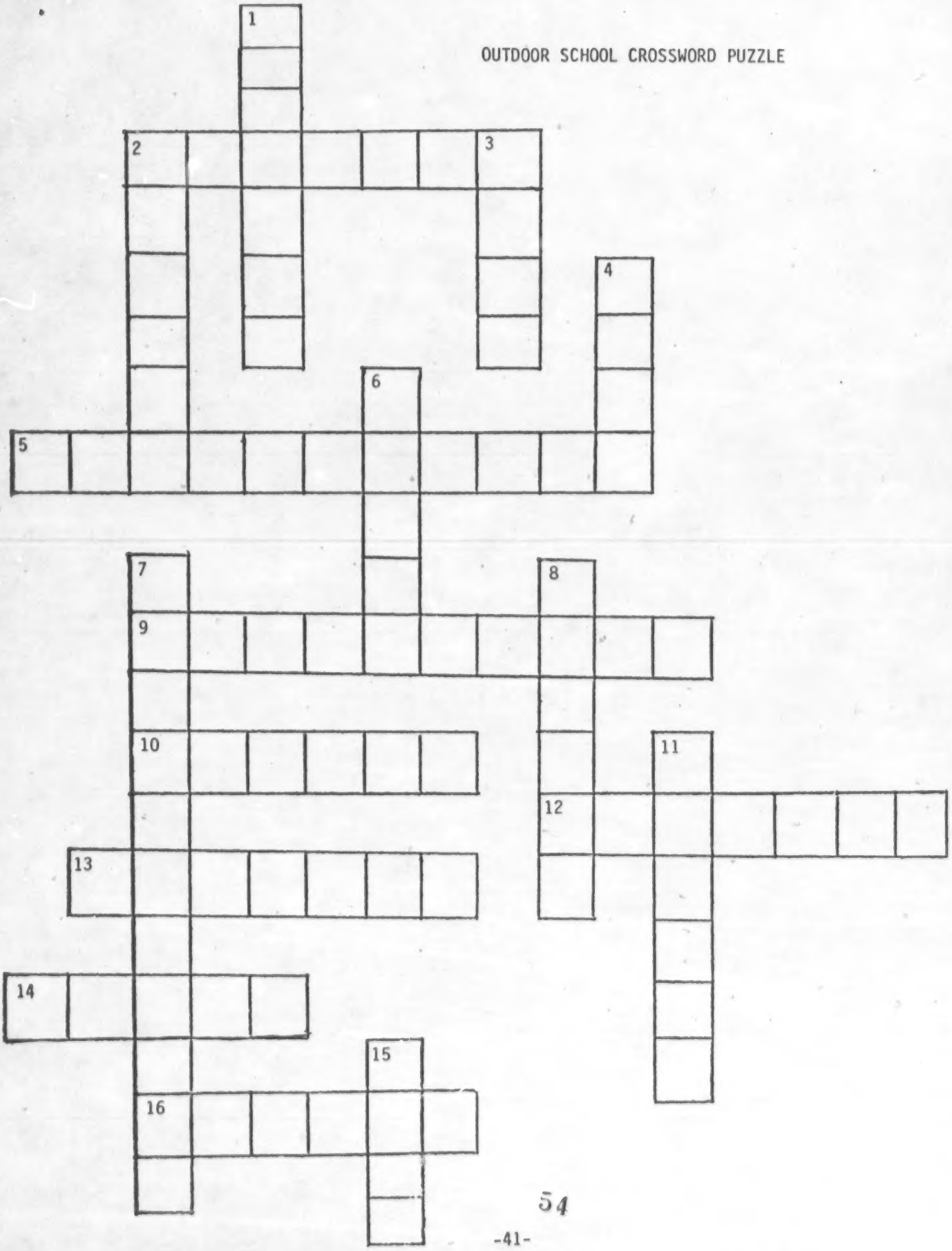
Swimming

K

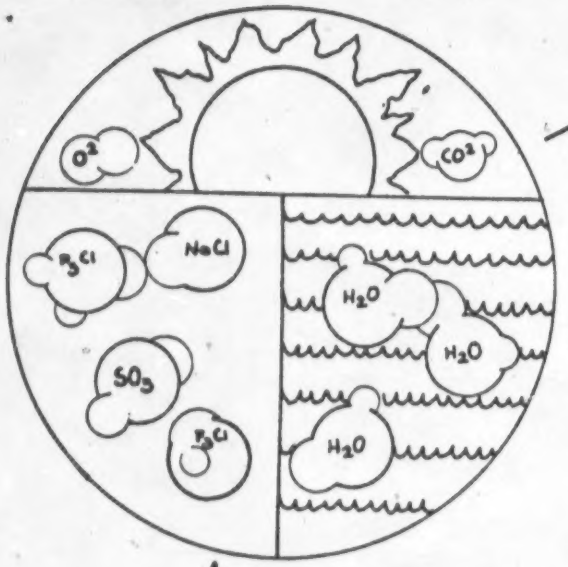
TEST YOURSELF ON YOUR ANIMAL KNOWLEDGE: FILL IN THE BLANKS USING THE NAMES OF ANIMALS THAT ARE FOUND AT OUTDOOR SCHOOL, IF YOU CAN. MOST OF THESE QUESTIONS COULD HAVE SEVERAL CORRECT ANSWERS.

1. A mammal that has become extinct in Oregon _____
2. An exotic animal that has become a pest in Oregon _____
3. A mammal that digs holes in the ground in which to live _____
4. A mammal that digs holes in which to store food _____
5. A mammal that never digs holes _____
6. A mammal that climbs trees to gather seeds for food _____
7. A mammal that climbs trees for shelter _____
8. A mammal that never climbs trees _____
9. A reptile that eats mice _____
10. A mammal that eats bushes _____
11. A mammal that eats crayfish and fresh-water clams _____
12. A bird that eats insects from under tree bark _____
13. A bird that eats dead and rotting animals _____
14. A bird that will eat almost anything _____
15. A bird that looks blue in bright light but black in shade _____
16. A bird that lives ONLY in evergreen forests _____
17. A bird that kills many rats and mice _____
18. A mammal that walks on it's toenails _____
19. An animal whose tracks look like a baby's hand print _____
20. An animal that has six legs _____
21. An animal that has eight legs _____
22. An animal with a smooth, moist, but not slimy skin _____
23. An animal with a dry, scaly skin _____
24. A four-legged animal that plants trees _____

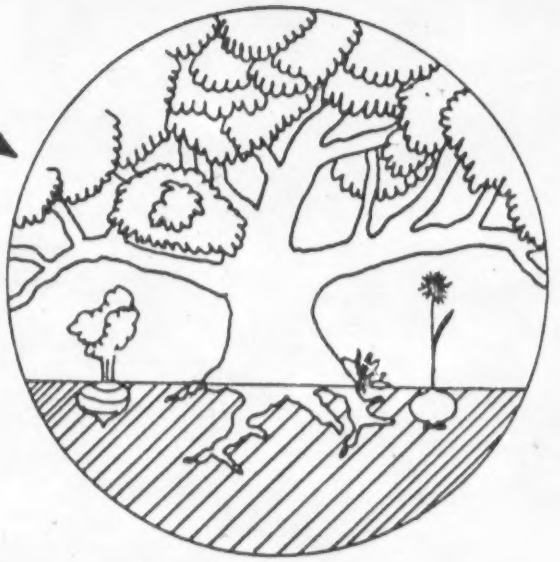
OUTDOOR SCHOOL CROSSWORD PUZZLE



ECOSYSTEM



Non Living Matter



Producers

An ecosystem is the sum total of all living and non-living parts supporting a chain of life within a selected area. The interaction of the four following links is critical in the functioning of an ecosystem. Any change in one link is bound to affect the others. This web-like relationship is the essence of the ecology of an area.

1. Non-living matter - The sunlight, water, oxygen, CO_2, soil with the organic compounds and mineral nutrients, used by plants for growth.

2. The Plants (Producers) - convert CO_2 and a water solution in a process called photosynthesis into organic compounds required both by themselves and other organisms in the ecosystem. Plants are our primary source of renewable wealth.

3. The Consumers - Higher organisms that feed on the Producers. Herbivores such as cows and sheep are primary consumers as are many insects. Carnivores, man and such animals as the coyote and lion feed upon herbivores and are the secondary Consumers. (Omnivores feed on both plants and animals.)

4. The Decomposers - Bacteria, fungi and insects close the system when they break down the dead Producers and Consumers and return their chemical compounds to the soil for re-use in plants.

Decomposers

Consumers

OUTDOOR SCHOOL CROSSWORD PUZZLE

DOWN

1) the surroundings of an animal that affects its life
2) plants that grow for one season only
3) plants that have flowers usually reproduce with _____
4) the materials from which independent plants get their minerals and much of their water supply
6) fungus plants reproduce with _____
7) the process by which water becomes a vapor in the air
8) warm-blooded, furry or hairy animals that bear their young alive and produce milk to feed the young.
11) the group of dependent plants including mushrooms, dodder, liverworts, mold, etc.
15) carnivorous animals eat only _____

ACROSS

2) living things - plant and _____
5) what plants must have in order to make their own food
9) mammals, birds, fish, reptiles, and amphibians are all examples of _____
10) no animals would survive for long without green _____
12) animals or plants living in water
13) caused by wind, eater, etc. on unprotected land
14) H_2O
16) the waste gas that green plants give off that is useful to animals

B	I	N	G	O
WEATHERING	BEDROCK	ACID	PARENT MATERIAL	SITE SUPERVISOR
ALKALINE	FRIENDS	STUDY PLOT	SAND	GROUND COVER
EROSION	SHEET EROSION	F R E E	TOPSOIL	pH
SUBSOIL	DECOMPOSE	ORGANIC	PLANTS	DUFF
BANK EROSION	CLAY	RILL EROSION	ECOLOGY	TERRACING

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-A-

B	I	N	G	O
PRESERVATION	PARENT MATERIAL	GROUND COVER	SAND	EROSION
FRIENDS	WEATHERING	SENIOR COUNSELOR	BEDROCK	SUBSOIL
RILL EROSION	CONSERVATION	F R E E	DUFF	ECOLOGY
pH	TERRACING	TOPSOIL	JUNIOR COUNSELOR	CLAY
SILT	ORGANIC	ALKALINE	ACID	WATER

59

-B-

DIRECTIONS: TO PLAY SOIL BINGO, CHOOSE JUST 1 OF THE FOUR CARDS. AS YOUR TEACHER READS A QUESTION, SEE IF YOU HAVE THE ANSWER TO THAT QUESTION ON YOUR CARD. IF YOU DO, PUT A MARKER IN THAT SPACE. WHEN YOU HAVE FIVE MARKERS IN A LINE, YOU HAVE BINGO.

AFTER YOU HAVE BEEN TO OUTDOOR SCHOOL YOU KNOW MANY MORE WORDS THAN ARE ON THESE CARDS. YOU MIGHT WANT TO MAKE MORE BINGO CARDS, USING ALL THE NEW WORDS YOU LEARNED AT OUTDOOR SCHOOL.

B	I	N	G	O
SOIL	ORGANIC	TOPSOIL	GROUND COVER	CLAY
DUFF	CONTOUR PLOWING	pH	CABIN	ALKALINE
TERRACING	FOSSIL	FREE	EROSION	BEDROCK
ECOLOGY	ACID	INORGANIC	FRIENDS	RILL EROSION
SUBSOIL	PARENT MATERIAL	WEATHERING	SAND	SOIL PROFILE

-C-

60

B	I	N	G	O
CAMPFIRE	SAND	SAND	ALKALINE	PARENT MATERIAL
ACID	GULLY EROSION	TOPSOIL	RESOURCE SPECIALIST	ORGANIC
RILL EROSION	GROUND COVER	FREE	ECOLOGY	ANIMALS
EROSION	WEATHERING	SPLASH EROSION	SUBSOIL	FRIENDS
pH	BEDROCK	TERRACING	CLAY	STRIP CROPPING

-D-

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LAND USE PLANNING

GOAL: To develop an awareness of the interrelationship of the natural resources and Man.

THE PROBLEM:

There is a large piece of land, 200 acres in size with woods, wildlife and water. Because of rising taxes, the owners of this land are forced to sell it. Your group has the money to buy the land. Your group must decide what you do with this land if you buy it.

What would your plan do to the:

(a) Plants
(b) Animals
(c) Soil
(d) Water

of the site?

A six person County Land Board will listen to each of the groups and decide which plan is the best for the land, the people and the resources.

THE PLAN MAKING:

On your large sheet of paper, your group will write up your plan.

I. What will you do with this land and how will it help or harm the:

(a) Plants
(b) Water
(c) Animals
(d) Soil

II. What will your group do about:

(a) Pollution
(b) Erosion
(c) Jobs
(d) Recreation
(e) Homes

THE PRESENTATION:

Each group must explain their plan to the County Land Board. The Land Board will vote on the best plan.